

Naval Medical Research Unit San Antonio focuses on improving device to remove dental waste

By David DeKunder | 502nd Air Base Wing Public Affairs | July 26, 2018

JOINT BASE SAN ANTONIO-FORT SAM HOUSTON, Texas —

Improving filtration devices that capture dental waste and keep the environment safe is the focus of a project being conducted at the Naval Medical Research Unit San Antonio, located at Joint Base San Antonio-Fort Sam Houston.

Dental researchers at NAMRU-SA are testing and developing options for Navy dental facilities, which use chairside amalgam separators to remove amalgam particulate waste from the wastewater so that it isn't released into the environment.

The amalgam separator is a cylindrical device attached to a dental chair that filters amalgam, a mixture of metals including mercury, which is used by dentists for large teeth restorations and to fill in cavities.

The amalgam separator uses a pleated filter inside of it, which, because it is folded, provides a very large surface area in a small space. This large surface area allows it to filter out most of the amalgam waste, while extending the service life of the separator.

Dental amalgam is an alloy comprised of 40 to 50 percent mercury along with silver, tin and copper. The amalgam is made by combining liquid mercury with the other metals in powdered form, yielding a paste which sets hard in minutes. The mixing is done in self-contained, pre-measured capsules which ensure optimal alloy formulation and prevent any leakage of mercury.

Dr. Dorian Olivera, NAMRU-SA Environmental Surveillance Department research toxicologist and principal investigator, said amalgam is effective and safe when used for teeth restorations, but waste particles from its placement or removal can be harmful if they enter the environment through disposal into wastewater.

A large number of cavities are filled each year by Navy dentists to ensure Sailors are ready for deployment. The dental amalgam waste produced from placing or removing amalgam restorations can result in a release of mercury into publically owned wastewater streams if it is not controlled at the dental clinic site.

Exposure to mercury can cause neurological damage in humans and symptoms may include muscle weakness, loss of peripheral vision and impairment in speech, hearing and walking. Exposure to methylmercury, an organic form of mercury, can affect a child's brain and nervous systems and could impact their cognitive thinking, memory and motor skills.

"When mercury is in amalgam, it's safe, it's immobile. It's not going anywhere," Olivera said. "But when the amalgam is installed or removed, particulate is generated and mercury can sneak out of that amalgam waste, especially when it's out in the wastewater where bacteria facilitate that process. Our main concern is to keep amalgam waste out of the effluent waste stream, meaning the water that leaves the dental facility."

The amalgam separator used in Navy dental facilities, the DD2011P model, has been certified 99.6 percent efficient in removing and filtering amalgam particulate waste, including mercury. The device helps prevent waste sludge buildup in the vacuum lines and central filtration systems of dental facilities, prolonging the life of the filtration system.

Olivera said the Navy requires the use of chairside amalgam separators because that puts them closest to the source of where the amalgam waste is coming from. He said having the filtration device as a chairside application is the most effective way to control the amalgam waste close to its source and limit contamination of other plumbing.

"When you consider a dental chair and putting waste down, if your source is at one location and the amalgam separator at another location, it can contaminate all the plumbing in between the source and the separator," Olivera said. "Eventually, the

Photos



pipes can fill with amalgam sludge to the point that the vacuum systems don't work. In that case, the plumbing must be carefully removed in segments to avoid the sludge spilling, and the plumbing then replaced. This can be a very expensive repair."

Lt. Cmdr. Nicholas Hamlin, NAMRU-SA Environmental Surveillance Department head and research dentist, said the Navy has worked for years to respond to this complex environmental challenge. Since the 1990s, he said the Navy has required its dental facilities to utilize the chairside amalgam separator.

Dr. Mark Stone, a dentist at the Naval Institute of Dental and Biomedical Research in Great Lakes, Illinois, designed the first chairside amalgam separator in 1995.

"Mark Stone designed the amalgam separator in the mid-1990s to address what he thought was an ethical need," Olivera said. "It was not a regulatory requirement, it was just the right thing to do."

Hamlin said the first amalgam separator designed by Stone has evolved into several commercial models, including the DD2010P model used at Navy dental facilities.

Olivera said a yearlong study conducted on the DD2011P amalgam separator model at the Budge Dental Clinic, located at JBSA-Fort Sam Houston, concluded that the device functions adequately under heavy use, with a service life of 3-5 months. In addition, the device meets and exceeds new Environmental Protection Agency regulations for removing dental waste from water systems that take effect in July 2020.

Those EPA regulations, which were published in 2017, will require that all existing dental facilities where amalgam is used be equipped with amalgam separators that remove 95 percent amalgam particulate waste from wastewater and employ several best practices to reduce mercury release from amalgam waste.

The DD2011P amalgam separator exceeds the new EPA requirement with a 99.6 percent efficiency rating in removing amalgam particulate waste from wastewater.

In recommending the DD2011P model to Navy dental facilities for usage, the NAMRU-SA researchers emphasize further research and development is needed to improve the operation and performance of the device.

Based on the findings brought up during the study at the Budge Dental Clinic, additional work at NAMRU-SA will focus on producing a prototype of an amalgam separator that will reduce the size of the device so it is not in the way of dentists who are treating patients, and balancing the size, life expectancy and disposal costs of the devices.

Past research at NAMRU-SA has led to changes that have made the filtration devices easier to operate. Those include injection molded quick-disconnect fittings that have made it quicker to change the amalgam separator, reducing change times from 20 to 3 minutes.

Olivera said the quick disconnect fittings helped the NAMRU-SA researchers in their study at the Budge Dental Clinic, as they were disconnecting and reconnecting the amalgam separators frequently to collect wastewater samples for analysis. Dental staff at the Budge Clinic and others have asked for the quick disconnect fittings and provided feedback that they are durable, easy to use, and a great time-saver.

Since NAMRU-SA is the lead agent for the Navy's Dental Mercury Abatement Program, it is providing guidance and technical support to Navy dental facilities in adhering to current local and state guidelines on the disposal of amalgam scrap and the use of amalgam separators and the new EPA regulations that take effect in 2020.

The abatement program allows personnel from Navy dental facilities to contact NAMRU-SA researchers and specialists about questions they have on the installation, maintenance and operation of amalgam separators.

Olivera said continued research into developing amalgam separators that are better will benefit the environment, help keep military dental facilities in compliance with regulations and benefit the service members and their families that utilize the dental facilities.

 [amalgam separator](#)  [Dental amalgam](#)  [JBSA-Fort Sam Houston](#)  [Joint Base San Antonio-Fort Sam Houston](#)
 [NAMRU-SA](#)  [Naval Medical Research Unit San Antonio](#)